CLAIMS

What is claimed is:

1. A fluorescence detection system, comprising:

A. a photonic band gap structure including an internal surface that defines a core region; wherein said internal surface of said photonic band gap structure is coated with a film formed of a plurality of molecules;

B. a sample fluid contained within said core region, said sample fluid having a plurality of microorganisms dispersed therein;

C. an optical source for generating excitation light directed to said sample fluid; wherein in response to said excitation light, at least one of said plurality of organisms is capable of interacting with at least one of said plurality of molecules so as to generate a fluorescent signal; and

D. an optical detector for detecting said fluorescence signal;

wherein said photonic band gap structure is adapted to guide said fluorescence signal through said core region and onto said detector for detection by said detector.

2. A fluorescence detection system according to claim 1, wherein said at least one of said plurality of microorganisms interacts with said at least one of said plurality of molecules through a binding event.

3. A fluorescence detection system according to claim 1, wherein said plurality of molecules include a plurality of conjugated polymer molecules.

4. A fluorescence detection system according to claim 1, wherein said fluorescent signal is characterized by a wavelength that falls within the band gap of said photonic band gap structure, whereby said fluorescent signal is adapted to be transmitted through said core region by reflections from said photonic band gap structure.

5. A fluorescence detection system according to claim 1, wherein said excitation light is characterized by a wavelength that falls outside of said band gap of said photonic band gap structure and within a transmission band of said photonic band gap structure, so that reflection of said excitation light from said photonic band gap structure is essentially eliminated, and so that said excitation light is prevented from being guided through said core region onto said detector.

6. A fluorescence detection system according to claim 1, wherein said fluorescence signal comprises fluorescence emissions from a plurality of molecules.

7. A fluorescence detection system according to claim 1, wherein the collection efficiency of said fluorescence detection system is about 25 %.

8. A fluorescence detection system according to claim 1, wherein the signal-to-noise ratio for said fluorescence detection system is about 30.

9. A fluorescence detection system according to claim 1, wherein said optical source is a laser.

10. A fluorescence detection system according to claim 1, wherein said plurality of microorganisms are selected from the group consisting of bacteria, antibodies, cells, and proteins.

11. A fluorescence detection system according to claim 1, wherein said optical detector is a photomultiplier tube.

12. A fluorescence detection system according to claim 1, wherein a volume of said fluid is less than about one microliter.

13. A fluorescence detection system according to claim 1, wherein a diameter of said core region is about 14.5 microns.

14. A fluorescence detection system according to claim 3, wherein said plurality of conjugated polymer molecules comprise an inorganic molecule.

15. A fluorescence detection system according to claim 14, wherein said inorganic molecule comprises TNT.

16. A fluorescence detection system according to claim 1, wherein said sample fluid comprises a liquid.

17. A fluorescence detection system according to claim 1, wherein said sample fluid comprises a gas.

18. A fluorescence detection system according to claim 4, wherein said wavelength of said fluorescent light is from about 400 nm to about 700 nm.

19. A fluorescence detection system according to claim 1, wherein said photonic band gap structure is selected from the group consisting of a photonic band gap fiber and a photonic band gap crystal.

20. A fluorescence detection system according to claim 1, wherein said photonic band gap structure is configured so that said core region is adapted to be filled with said fluid via a capillary action.

21. A detector array for fluorescence detection, said detector array comprising:

A. an array of photonic band gap fibers, each photonic band gap fiber including an internal surface that defines a hollow core region;

wherein each internal surface of each photonic band gap fiber is coated with a film formed of a plurality of conjugated polymer molecules; and

B. a fluid contained within each core region in each photonic band gap fiber, said fluid having a plurality of sample organisms dispersed therein;

C. an optical source for generating excitation light directed to a sample bearing portion of said fluid in each core region;

wherein in response to said excitation light, at least one of said plurality of sample organisms is capable of binding with at least one of said plurality of conjugated polymer molecules so as to generate a fluorescence signal; and

D. a detector for detecting said fluorescence signal;

wherein each photonic band gap fiber is adapted to guide said fluorescence signal through said core region and onto said detector for detection by said detector.